Radiographic Dental Films

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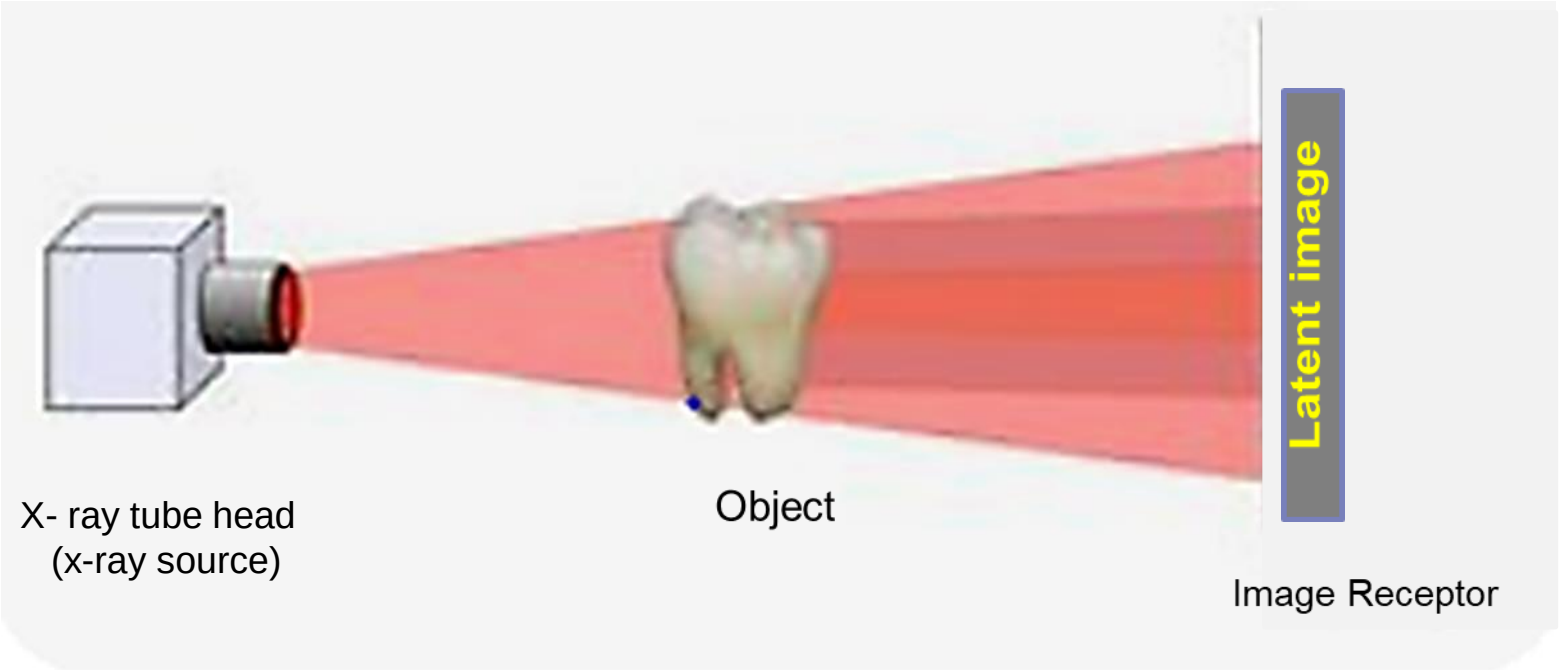
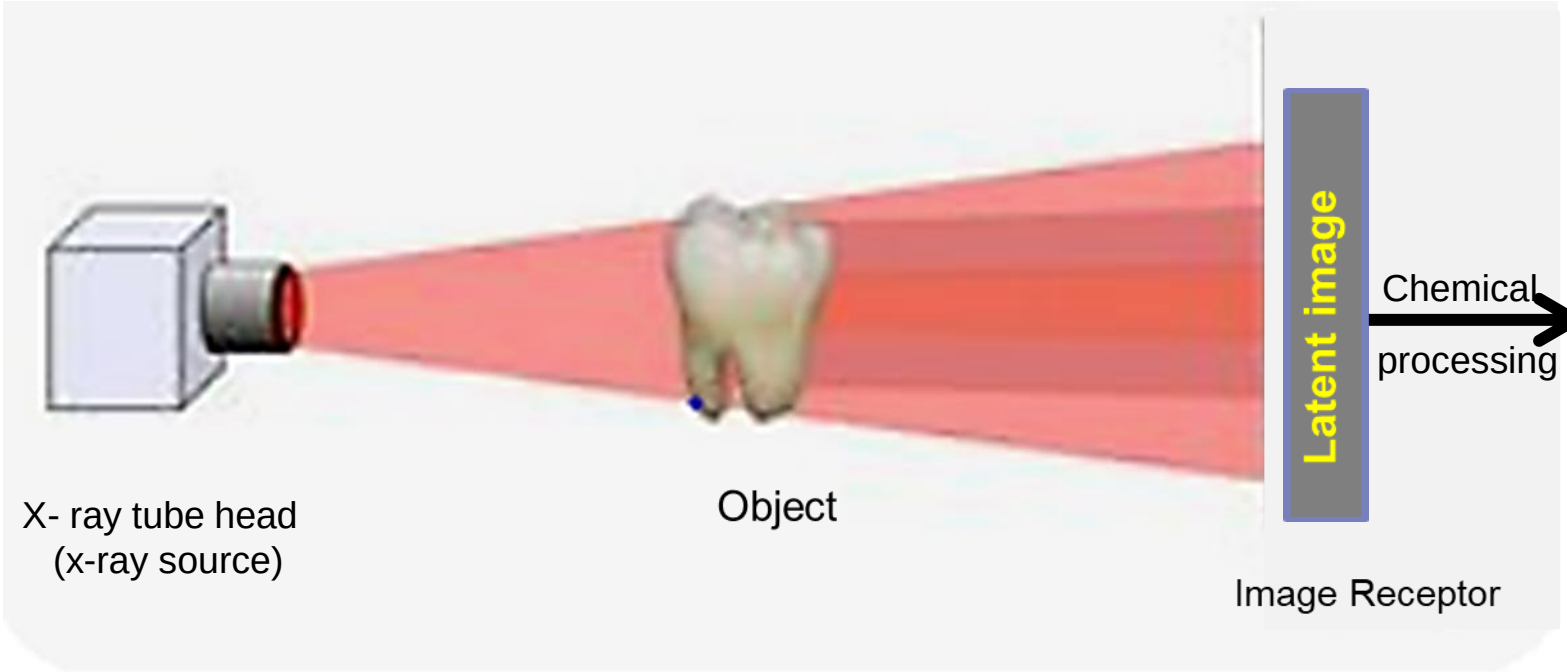
How is a Radiographic Image Formed?

Image Formation



After exposure to radiation the remnant beam carries information about the structure & composition of the object to be radiographed. The remnant beam must be recorded on an image receptor (Dental film) and form latent image (Invisible image).

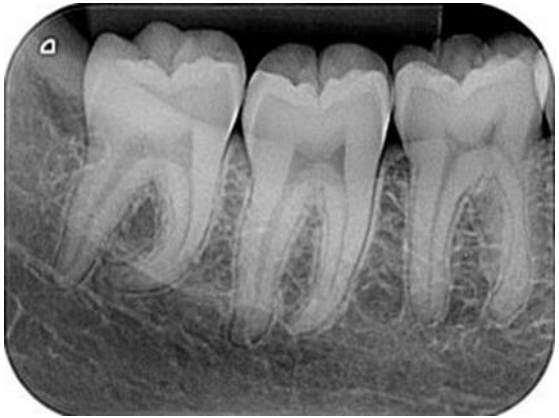
Image Formation



This remnant beam to be diagnostically useful, it must be converted into a visible Image by chemical processing

Dental film VS Dental Radiograph

Processing



Dental Film
Latent image (After exposure and before processing)

Dental Radiograph
Visible image (After processing)

Image Receptors

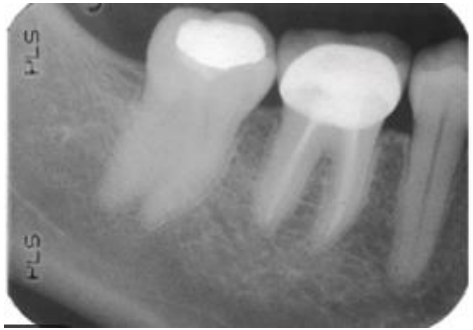
Analogue

Digital plates

Conventional dental film can be processed chemically by chemical solutions.
Digital receptor receives the image and digitally processed to a visible image.

Dental Film

Intraoral film



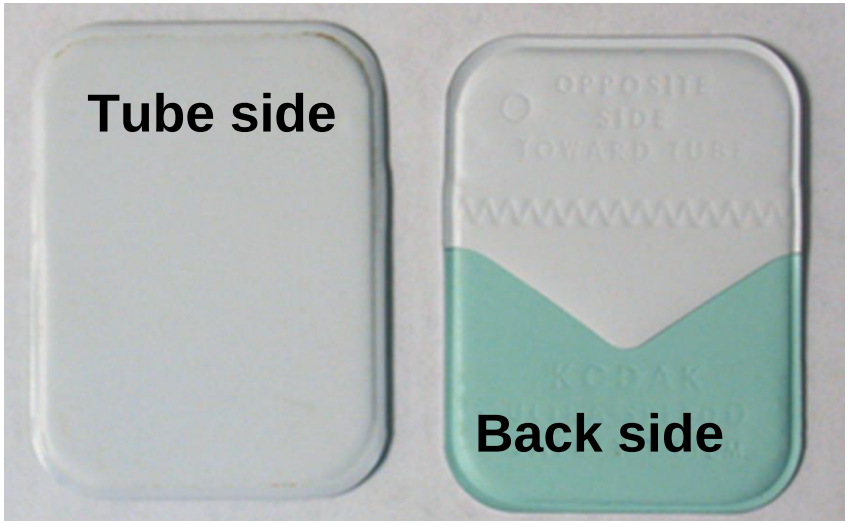
Extraoral film

1 Intraoral Film

Component of x-ray film packet

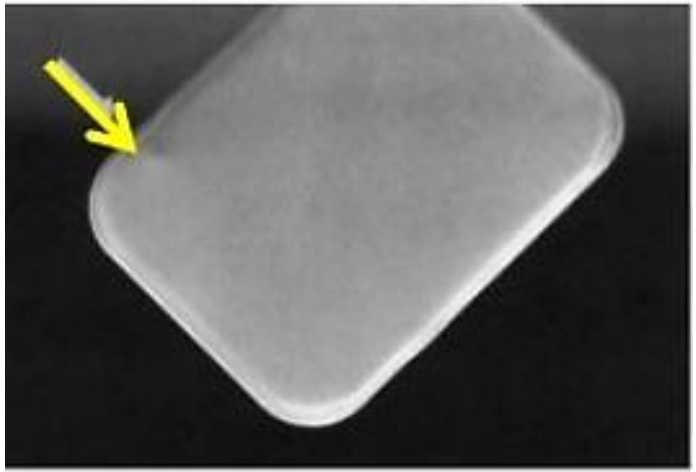
Film packet Components are:
1- Outer cover
2- Lead Foil
3- Black paper wrap
4- Dental film

Dental film packet



Dental film packet has two sides;
1- Tube side which is hold facing the X-ray. It is smooth or pebbled to prevent its slippage.
2- Back side (Label side) which is placed away from the X ray source. It may be colored, has a flap and printed Information (film speed, size, number of films, manufacturer's name).

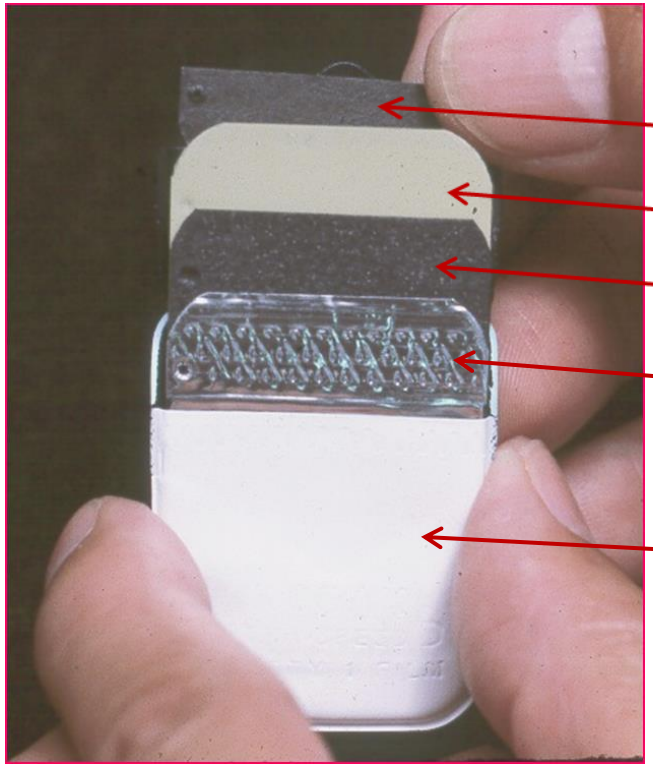
Dental film packet



Embossed Dot:

A small, raised dot known as the identification dot is located in one corner of the intraoral X-ray film.
This raised dot is used to distinguish between the left and right sides of the patient after the film is processed; hence, it is significant in film orientation, mounting and interpretation.

Dental film packet



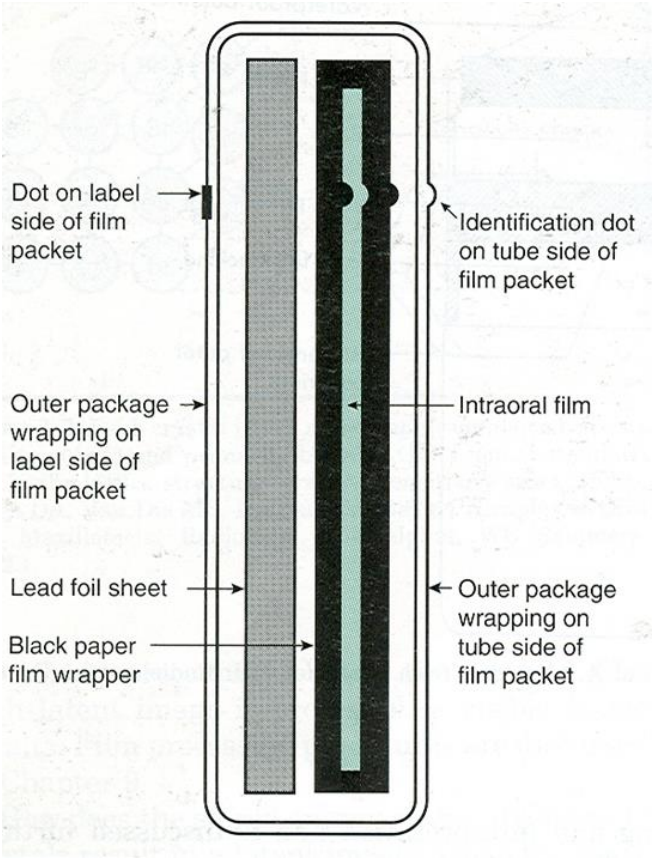
Black paper wrap of tube side

Intraoral film

Black paper wrap of back side

Lead foil

Outer cover of back side


Dot on label side of film packet
Identification dot on tube side of film packet
Outer package wrapping on label side of film packet
Intraoral film
Lead foil sheet
Outer package wrapping on tube side of film packet
Black paper film wrapper

Dental film packet

Film packet Components are:

1- Outer cover

2- Black paper wrap

3- Lead Foil

4- Dental film

Material

- Cardboard

- Plastic

Properties

-Resistant to moisture

- Has 2 sides back side and tube side

Function

- Protects the film from exposure to light and saliva.

Dental film packet

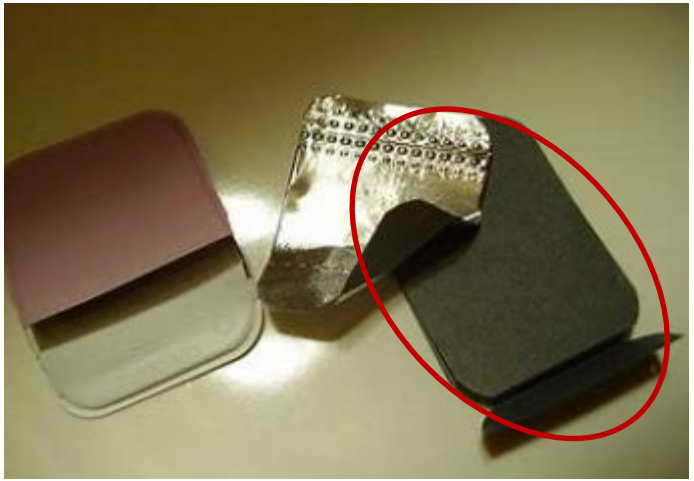
Film packet Components are:

1- Outer cover

2- Black paper wrap

3- Lead Foil

4- Dental film



Material

- protective sheet of black paper that covers the film.

• Properties

- **Black**
- **Complete Wrapping around the film**

-Function

- It shields the film from light leak.

Dental film packet

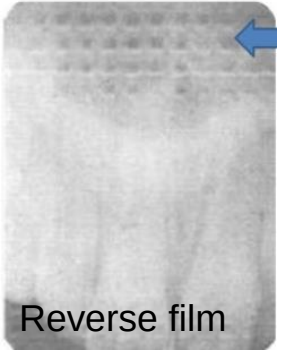
Film packet Components are:

1- Outer cover

2- Black paper wrap

3- Lead Foil

4- Dental film



Reverse film

Material

- Single thin piece of lead foil

Properties

- Positioned behind the film it absorbs most of the X-rays that passes through the film

- Dotted pattern

Function

- Protects oral tissues

- Absorbs back scatter radiation

- **Provides strength to the film packet**
- **Reverse film = dotted pattern' and film appears faint**

Dental film packet

Film packet Components are:

1- Outer cover

2- Black paper wrap

3- Lead Foil

4- Dental film

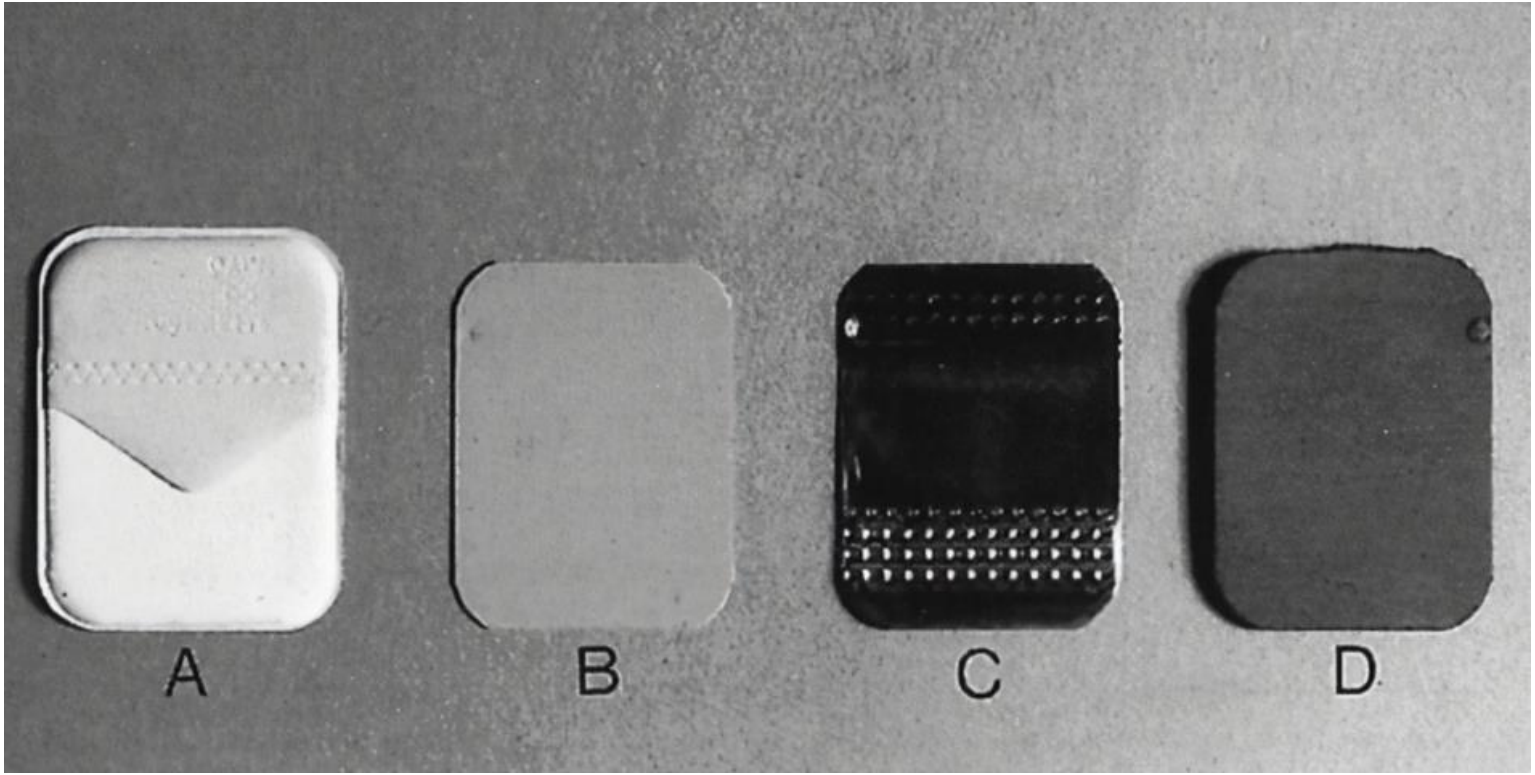
Material

Properties

- Sensitive to x-ray more than light

Function

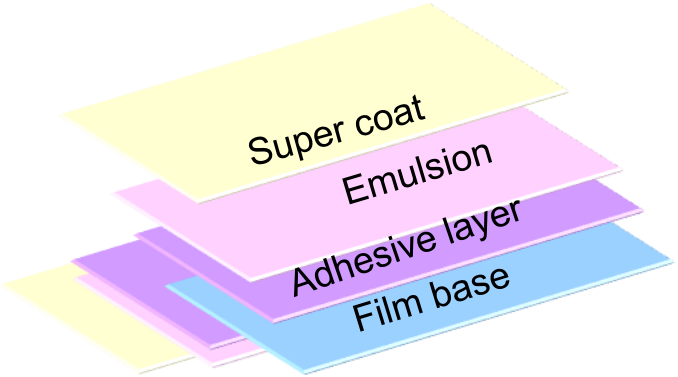
- Receive x-ray and on which image is formed.

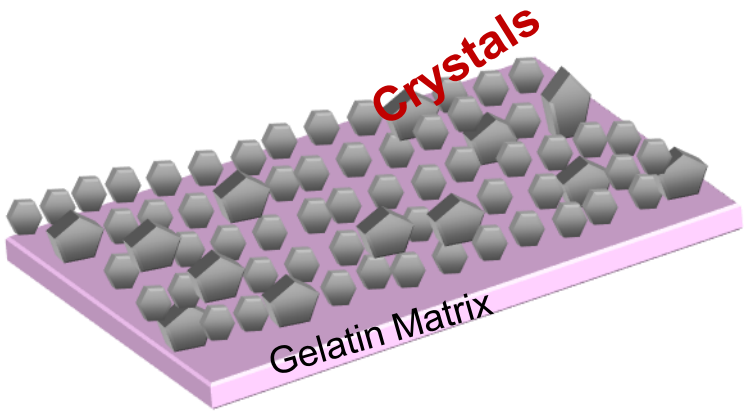

A
B
C
D

Composition of Dental Film

Composition of Dental Film

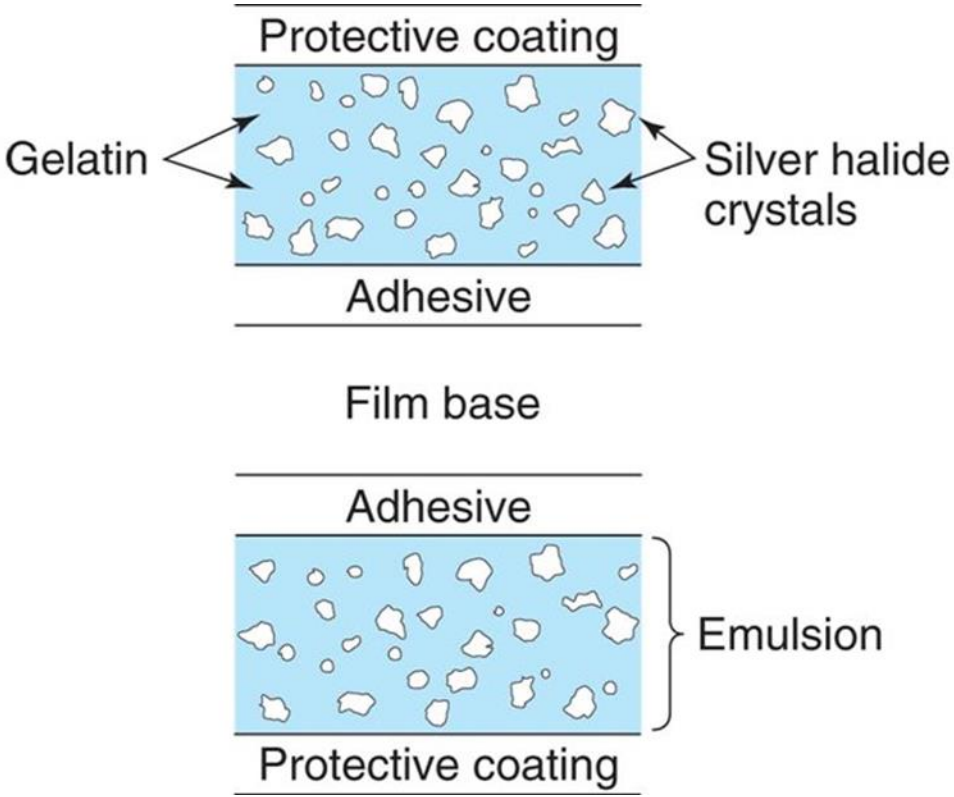
- **X-ray film has 2 major components: Emulsion & Base.**





Film emulsion = Silver halide grains suspended in a Vehicle Matrix made of Gelatine and both are coated on a Plastic Film Base .

Composition of Dental Film



Composition of Dental Film

X-ray film has 2 major components:

1- Dental film Base

2- Emulsion

Material

- **Cellulose acetate**
- **Cellulose nitrate**

(dimensionally unstable)

Properties

- **Flexible**
- **Transparent**
- **Blue tint**
- **High melting point**
- **Dimensionally stable**

Function

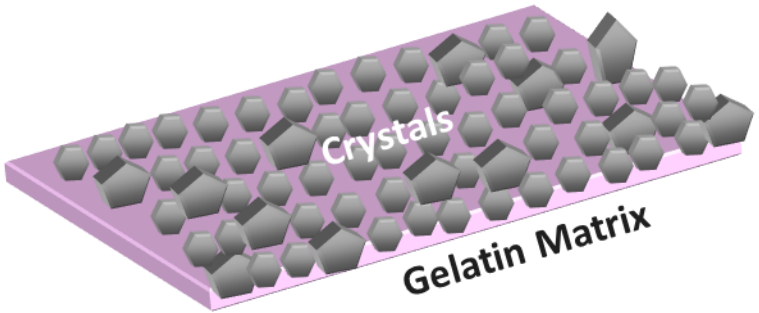
- **Skeleton supports the emulsion layer Provides strength**

Composition of Dental Film

X-ray film has 2 major components:

1- Dental film Base

2- Emulsion



Material

- Silver halide crystals and gelatin matrix

Properties

- Comparative hardness that allow penetration of the chemical solution

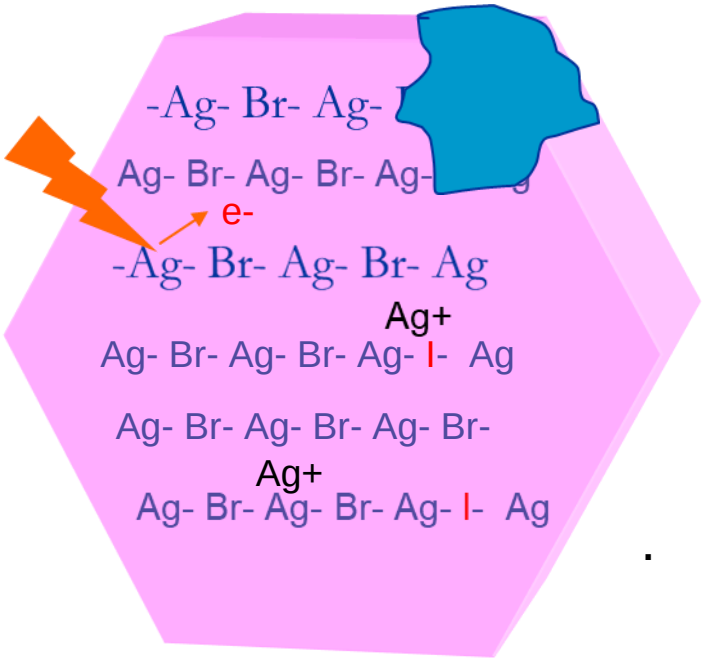
Function

- Sensitive component to an x-ray and visible light

Which Component of the X- ray Film is Responsible for Image Formation ?

Silver Halide Grains

Silver Halide Grains



Material

- **Silver bromide 80-90%**
- **Silver iodide 1-10%**
- **Free silver ions**
- **Sensitivity site= sulfur+gold**

Sensitivity sites **are Physical Irregularities made by the addition of iodide which are larger in size than the bromide, and the presence of trace amounts of Sulfer Containing Compounds & Gold binding the surface of the crystals**

Function

- **Receive x-ray and on which image is formed.**

Gelatin matrix

Material

Gelatinous and non gelatinous materials

Function

- Framework for silver halide crystals
-Absorbs solution and swollen allowing penetration of chemical solutions

Properties

Porous **In both sides** **Withstand temperature**
Clear
Inert **Allows even distribution of crystals**

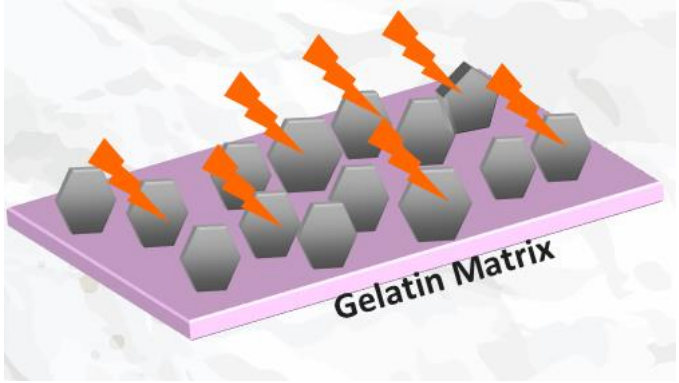
Radiographic Speed or Sensitivity

Radiographic Speed is the amount of radiation required to produce a radiographic image of standard density

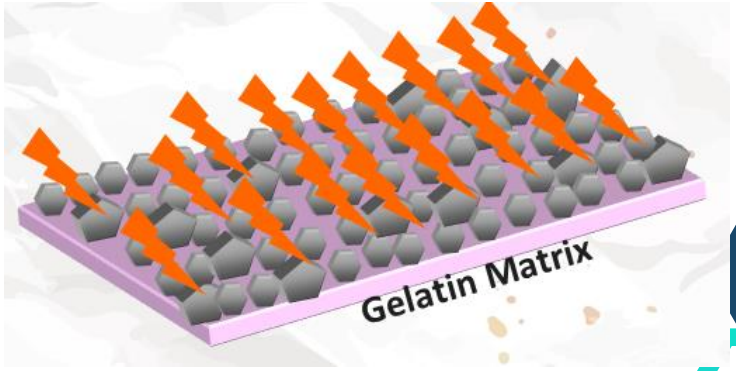
Factors Affecting The Film Speed

Crystal size

Larger size
less amount
Higher speed
Less sharpness

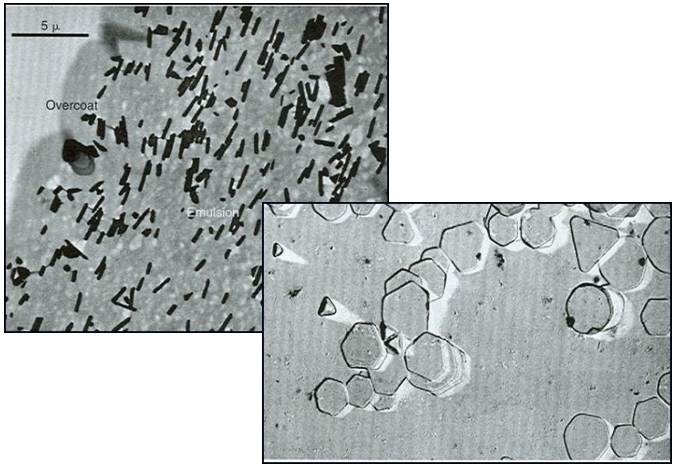


Smaller size
Larger amount
Less speed
Higher sharpness



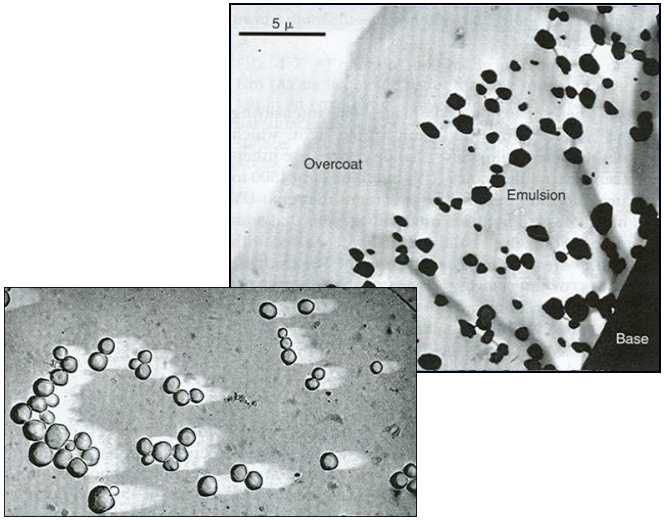
Factors affect the film speed

Flat tabular crystals
small amount of radiation
larger in size
Larger surface area
richer in the silver halide



Crystal shape

Globular crystal
Large amount of radiation
Small in size

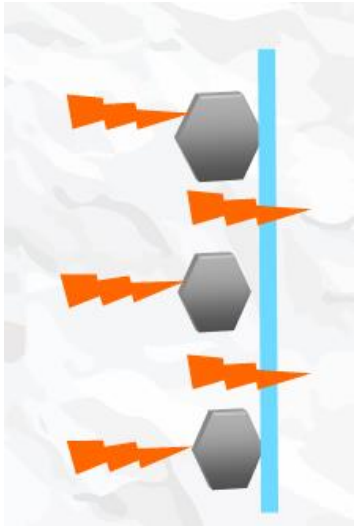


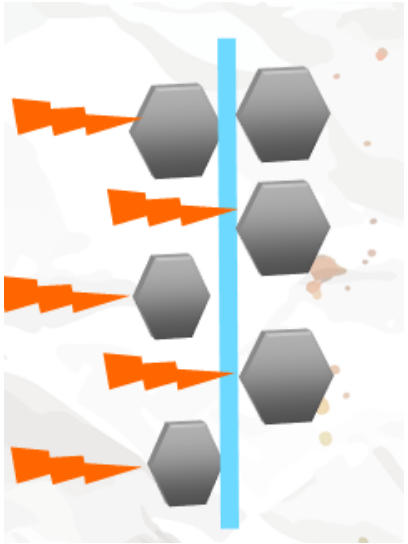
Factors affect the film speed

Single coat
Larger amount
Less speed
Higher sharpness

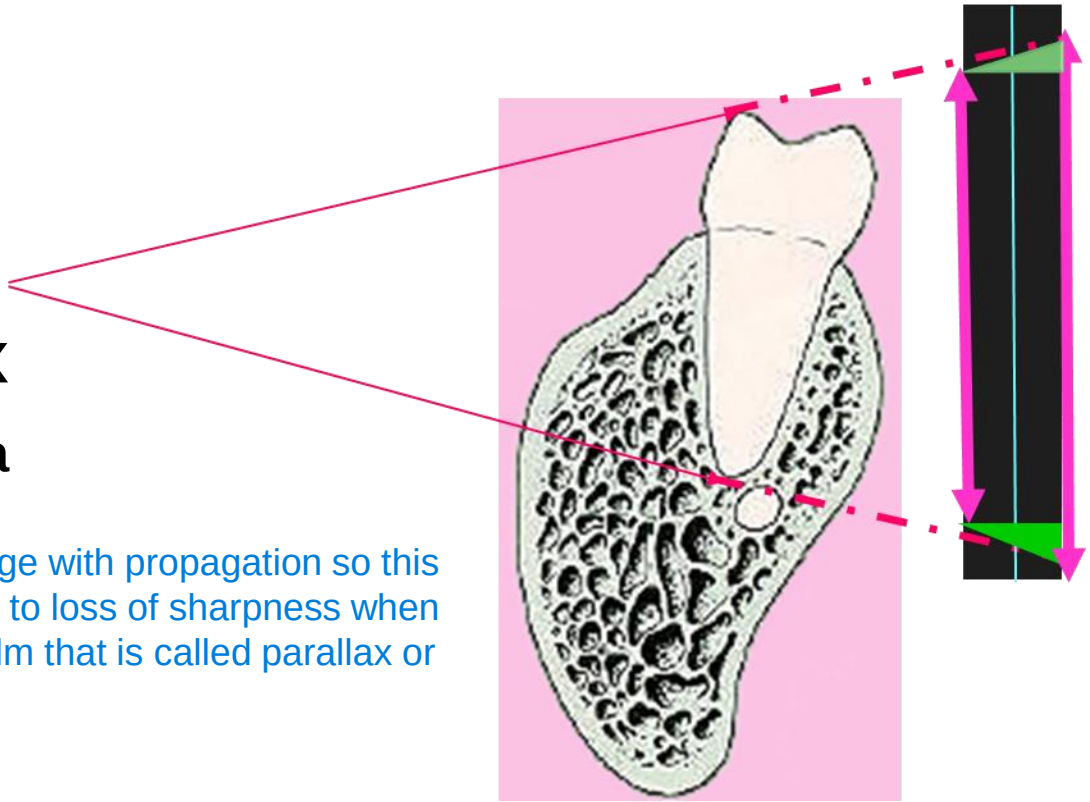
Emulsion Coat

Double coat
Less amount
Higher speed
Less sharpness





Emulsion Coat



Parallax

Penumbra

X-ray tends to diverge with propagation so this divergence will lead to loss of sharpness when using double coat film that is called parallax or penumbra

Double coat
Less amount
Higher speed
Less sharpness

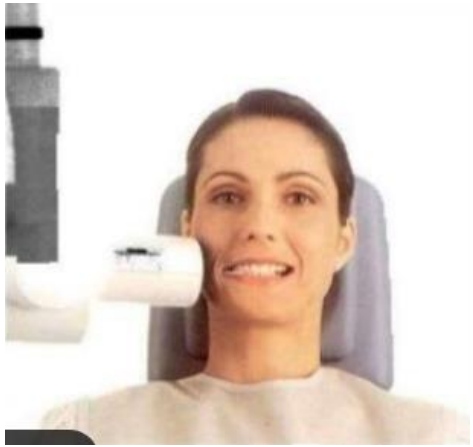
Classification of Intraoral Dental Film

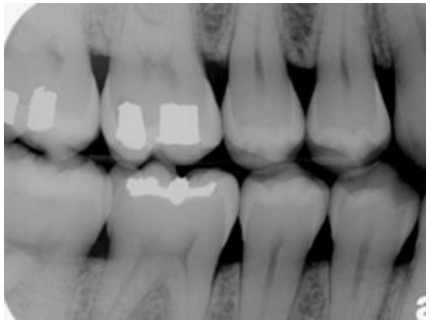
1. Uses
2. Sizes
3. Speed
4. Number of films per packet
5. Cassettes usage or not
6. Emulsion coating
7. Leaded or not
8. Material

Uses

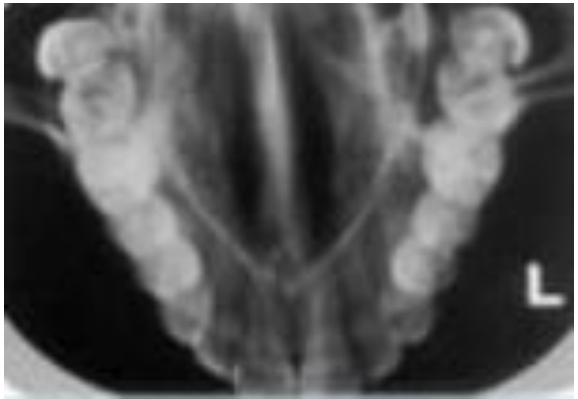
Periapical films

Bitewing film

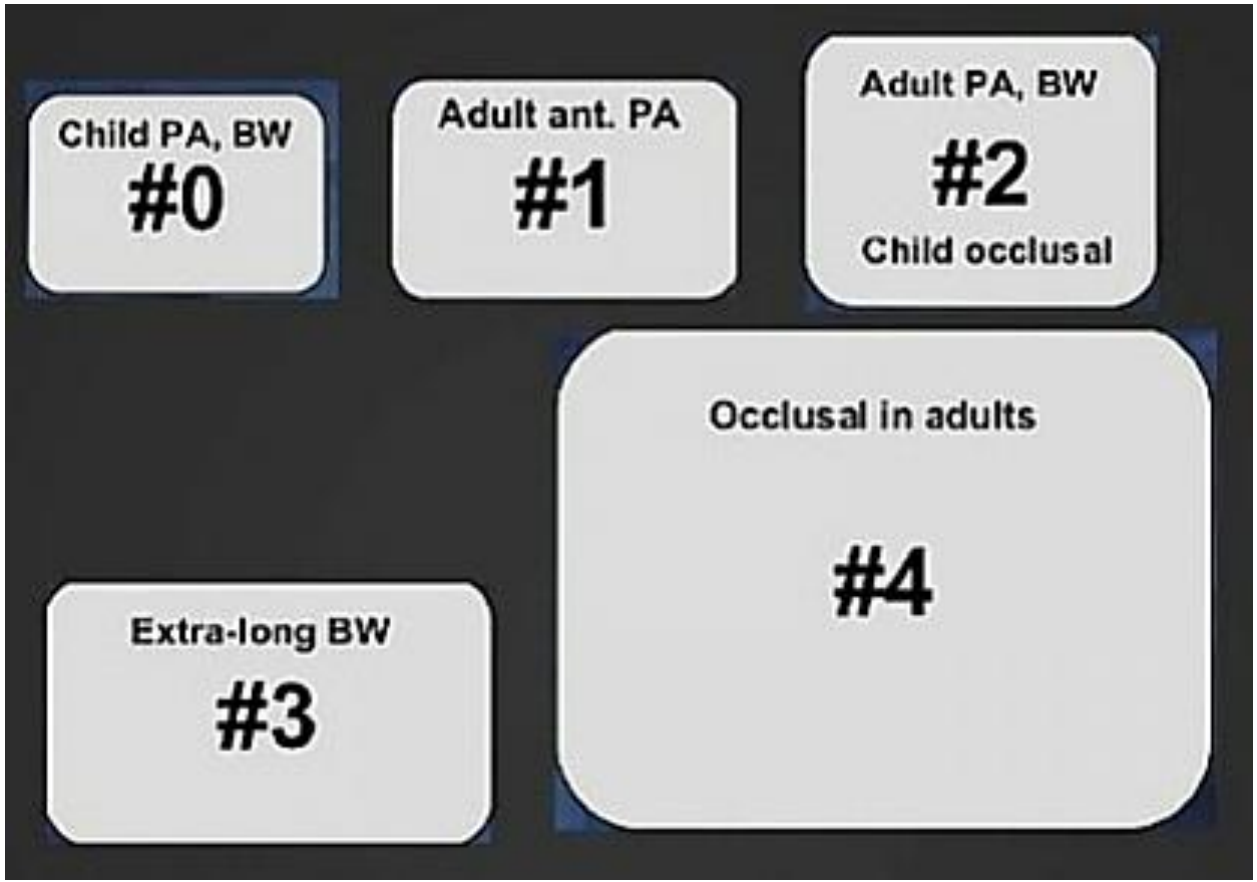




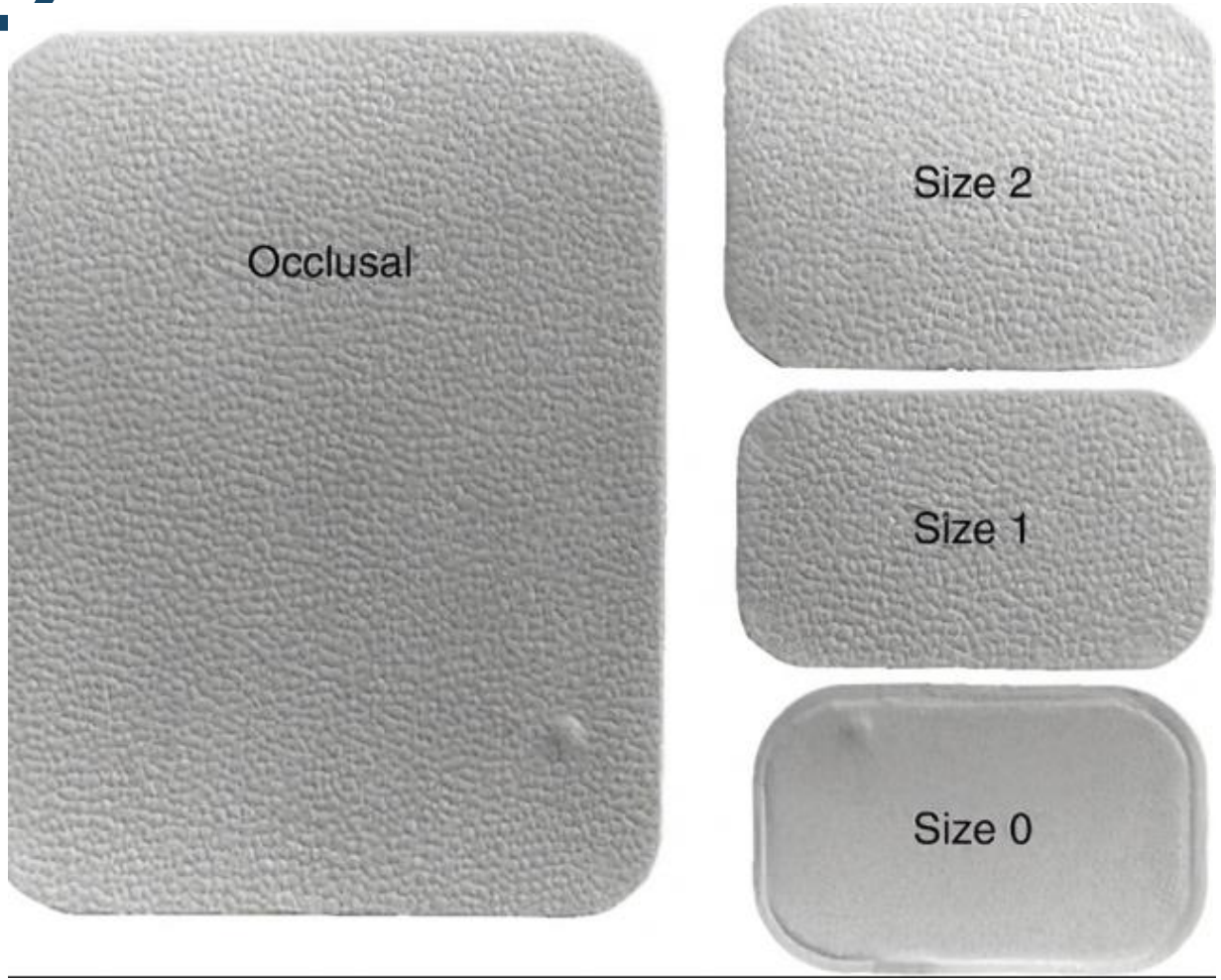
Occlusal film



Size


Child PA, BW
#0
Adult ant. PA
#1
Adult PA, BW
#2
Child occlusal
Occlusal in adults
#4
Extra-long BW
#3

Occlusal.
4,PED



PERiapical.
0,1,2

Bitewing
0,1,2,3

American National Standard Institute
ANSI

Use

1:Periapical
2:Bitewing
3:Occlusal

Size

#0
#1
#2
#3
#4

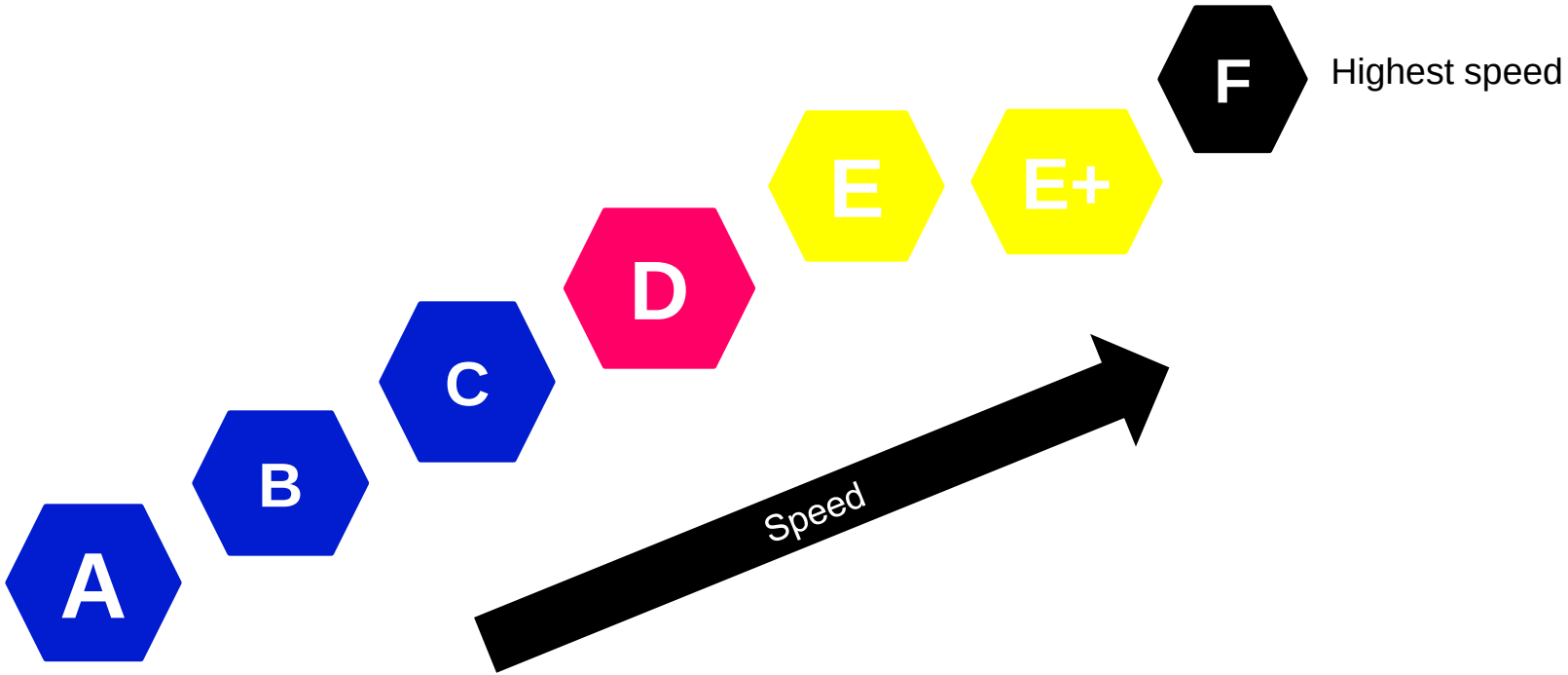
1.2= **Periapical, film size 2**

3.3= **Bitewing, film size 3**

1.0= **Periapical, film size 0**

3.4= **occlusal. Film size 4**

Speed



Intra- Oral Film with Lead foil backing inside the packet or not

- **With Lead foil backing**
- **Without Lead foil backing**

Intra- Oral Film used cassettes or not

- **Never used with cassettes: Periapical / Bitewing**
- **Could be used with cassettes: Occlusal**

Emulsion coating

- **Double coating films**
- **Single coating films**

Number of films per packet

- **Single film per packet**
- **Double film per packet**

2

Extraoral Film

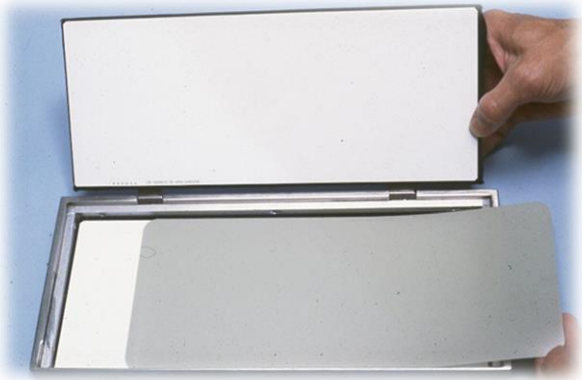
Extraoral Image Receptors

Analogue

Digital

Extraoral films

Cassette + the intensifying screens



Cassette

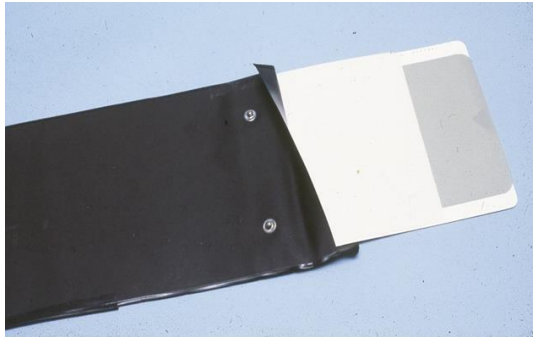
Skull

Panorama

Occlusal

panoramic cassettes

Flexible

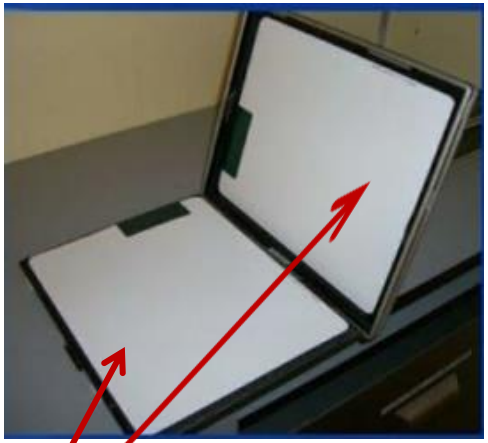


Rigid

Composition of The Cassette

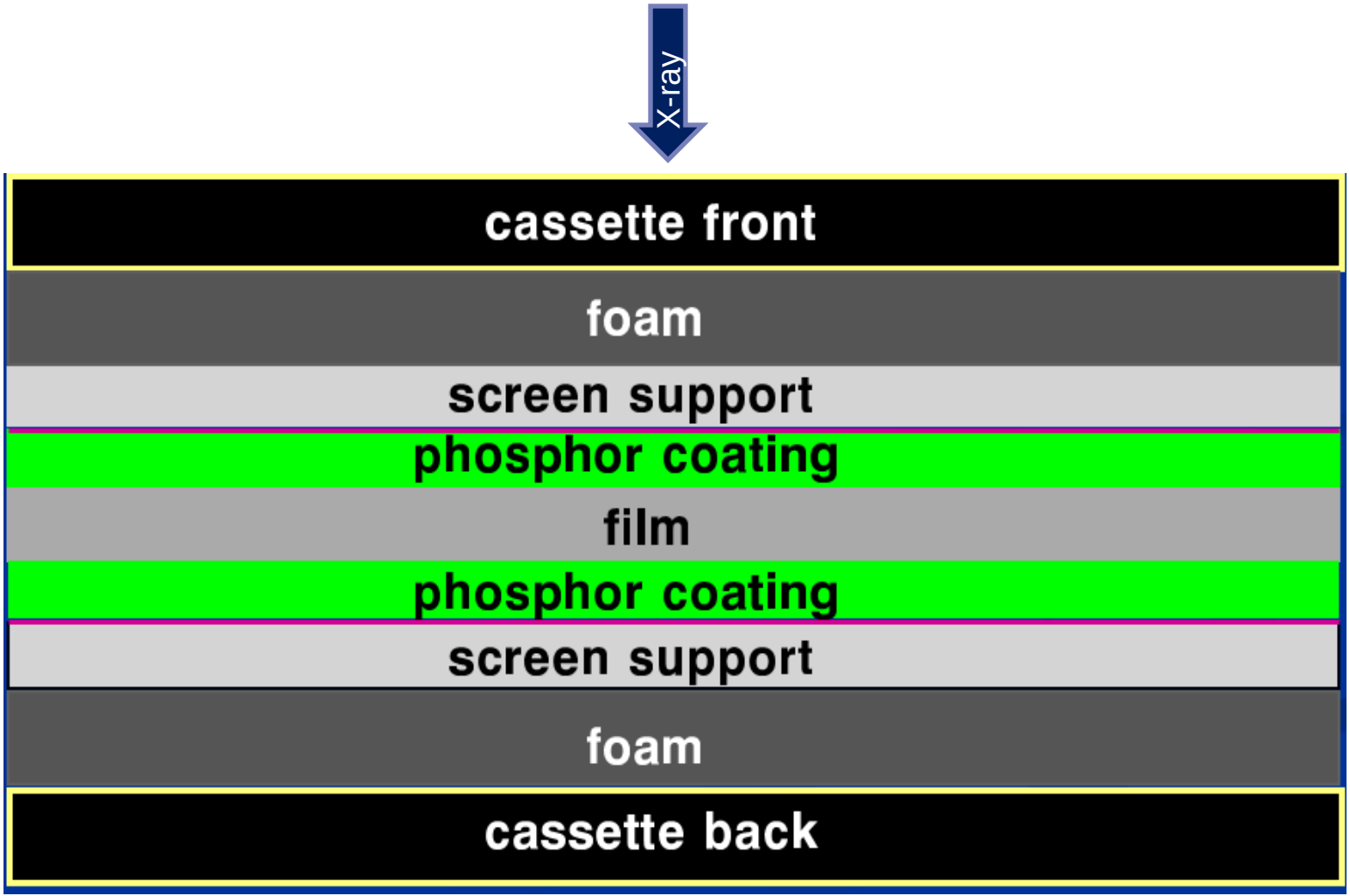
1- Front side: Aluminum or cardboard or plastic
2- Back side: Lead
3- Locking clamps to ensure light tight locking
4. Two Intensifying screens
5- Foam padding to ensure an intimate contact between the film and the screens

Composition of The Cassette



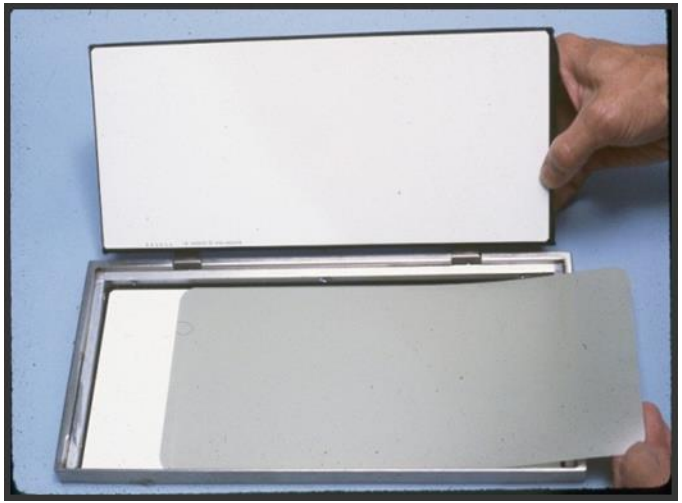
Intensifying screens

Foam padding


X-ray
cassette front
foam
screen support
phosphor coating
film
phosphor coating
screen support
foam
cassette back

Intensifying Screen

It intensifies the effect of x-ray on the film without the need for raising the exposure parameters of the original beam.



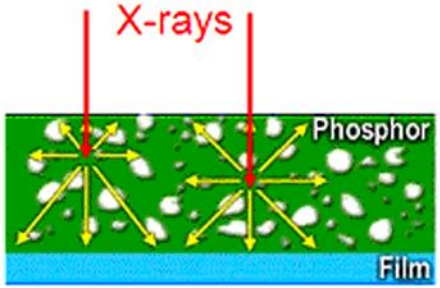
The intensifying screens technology creates an image receptor system that is 10 – 60 times more sensitive than the film alone.

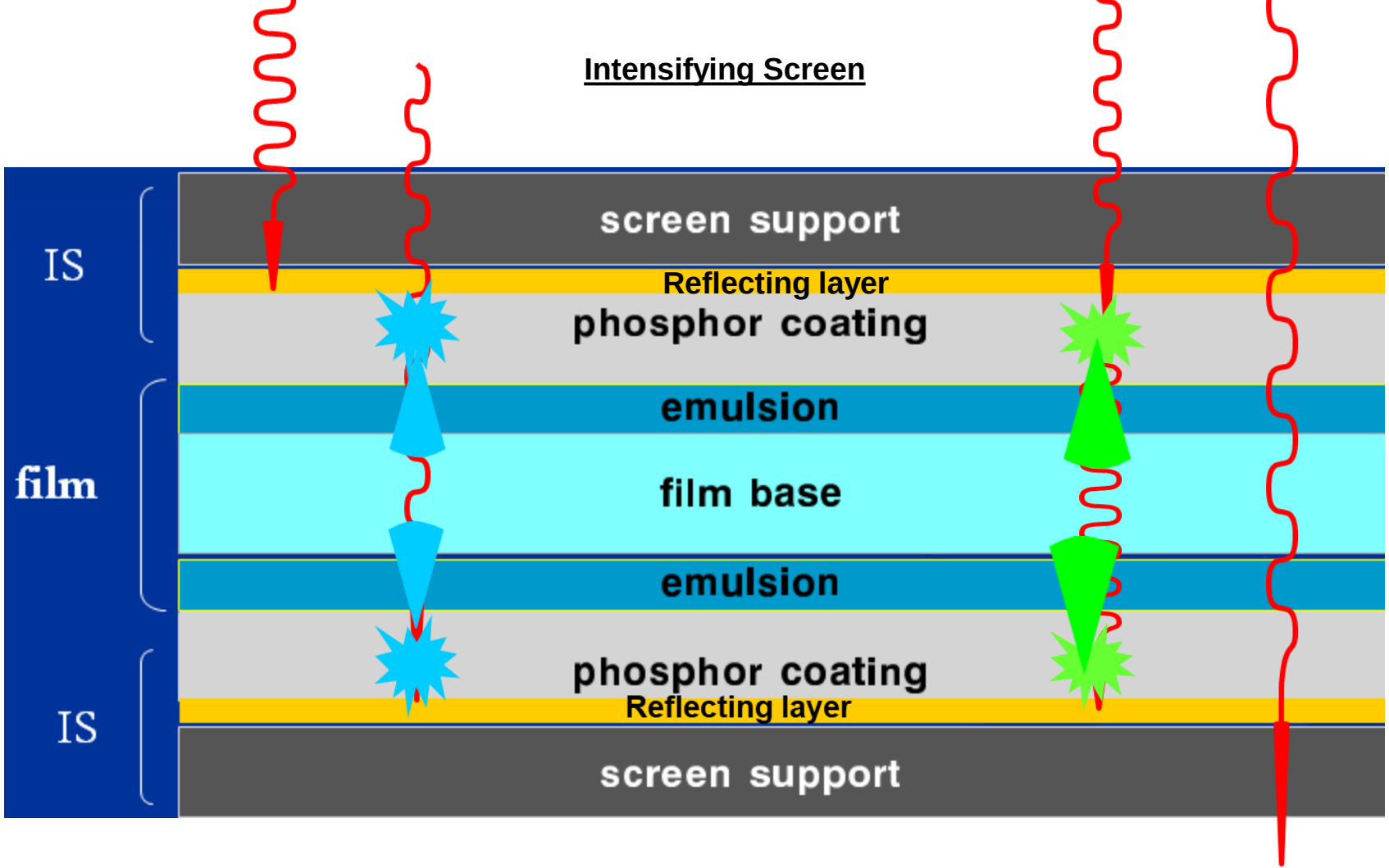
Principle of Intensifying Screen

1- X-ray hits the phosphor crystals emitting light which is emitted to any direction.

2- A reflecting layer reflects the emitted light to the direction of film.

3- An absorbing dye is placed at the film base to absorb the returning light from the other side to prevent cross over effect.




Intensifying Screen
IS
film
IS
screen support
Reflecting layer
phosphor coating
emulsion
film base
emulsion
phosphor coating
Reflecting layer
screen support

Types of Screens according to the Emission Characters (Phosphor layer)

Conventional Screens

Emitting Blue Visible Light or UV Light

The fluorescent crystals are
Calcium tungstate
Barium lead sulfate

Rare Earth Screens

Emitting Green Visible Light

The fluorescent crystals are
Gadolinium
Lanthanum
more efficient

Require less exposure time
More commonly used

Screen speed & Resolution is affected by:

1. Phosphor **Grain size**

2. Phosphor **Type** & Its Conversion Efficiency

3. **Thickness** of phosphor layer

4. Presence of **Reflective** Layer

5. Presence of **Light- Absorbing Dye** in the protective coat

Advantages of using intensifying screens with the extraoral films

Reduction of the x-ray dose to which the patient is exposed

Disadvantages of using intensifying screens with the extraoral Film

Reduce the Resolution of Extra-Oral Radiographs

1- Spread out of light beyond the point of origin and expose a larger area of the film than the phosphor crystal

2. Crossover the film base and expose the emulsion on the other side, causing more blurring of fine details.

3. Lack of intimate contact between the film and the screen may cause loss of details

4. Reflective layer

5. Screens with large crystals and thicker layer of phosphor offers less sharpness.

Classifications of Extraoral film

1. **Uses**
2. **Sizes**
3. **Speed**
4. **Sensitivity to the spectrum of light**
5. **Emulsion Coating**

USES

Panoramic films

Films for Skull views

sensitivity to the spectrum of light

- Blue-light sensitive(Kodak X-Omat films)
- Green light sensitive (T-Mat films)
- Ultra-Violet light sensitive (X-Omat and Ektavision)

Material of film packet

- **Plastic**
- **Cardboard**

Speed

- **Medium**
- **Ultra-speed (high)**

Emulsion coating

- **Double coating films**
- **Single coating films**

Thanks!